**Placement in the Course, Teacher Knowledge, Skills, and Preparation Needed**

**Explain where and why this lab should be placed in the overall unit plan, and how it fits with the “Big Ideas” for the chemistry unit.**

The Solubility Lab will be placed in the middle of the second week of the unit plan. At this point, students will be familiar with an acid-base titration from SCH3U and fundamental equilibrium concepts from the first week and a half of the unit. The lab will serve as a “warm-up” to the major Titration Lab at the end of the unit. As well, the inquiry-based lab will motivate students to use HOTS and practise calculations.

One of the Big Ideas for our unit is that “chemical systems are dynamic and respond to changing conditions in predictable ways”. In our lab, students will use their theoretical background knowledge to hypothesize how a chemical system will respond to changes in volume and temperature. Students will compare their predictions and results while explaining any discrepancies.

**State the appropriate background knowledge the teacher should know (content knowledge, skills, and safety issues).**

SCH3U

C2.9 investigate neutralization reactions (e.g., neutralize a dilute solution of sodium hydroxide with a dilute solution of hydrochloric acid, and isolate the sodium chloride produced)

D2.3 solve problems related to quantities in chemical reactions by performing calculations involving quantities in moles, number of particles, and atomic mass

E2.2 solve problems related to the concentration of solutions by performing calculations involving moles, and express the results in various units (e.g., moles per litre, grams per 100 mL, parts per million or parts per billion, mass, volume per cent)

E2.5 write balanced net ionic equations to represent precipitation and neutralization reactions

E2.6 use stoichiometry to solve problems involving solutions and solubility

E3.3 explain the effects of changes in temperature and pressure on the solubility of solids, liquids, and gases (e.g., explain how a change in temperature or atmospheric pressure affects the solubility of oxygen in lake water)

SCH4U

E2.2 predict, applying Le Châtelier’s principle or the reaction quotient for a given reaction, how various factors (e.g., changes in volume, temperature, or concentration of reactants or products in a solution) would affect a chemical system at equilibrium, and conduct an inquiry to test those predictions

E2.3 conduct an inquiry to determine the value of an equilibrium constant for a chemical reaction (e.g., Keq for iron(III) thiocyanate, Ksp for calcium hydroxide, Ka for acetic acid)

E2.5 solve problems related to acid–base equilibrium, using acid–base titration data and the pH at the equivalence point

E3.4 identify common equilibrium constants, including Keq, Ksp, Kw, Ka, Kb, and Kp, and write the expressions for each

Students should be wearing lab goggles at all times and lab coats if possible. Teacher must know the location of the eye wash station and how to operate it. Teacher must know how to contain and clean up an acid or base spill. Since sodium hydroxide is caustic and hydrochloric acid is corrosive, the teacher must be aware of their MSDS. All reagents are sufficiently dilute such that they can be flushed down the sink with copious amounts of water.

**Include a sample set of data for any observations students might make while carrying out the lab.**

See Teacher’s Notes for Solubility Lab.

**Provide answers to any of the pre-lab and post-lab questions.**

See Teacher’s Notes for Solubility Lab.

**Laboratory Set-up and Diagram**

**Assume that the experiment will be done in Room 322 or other lab classroom space with 24 students. Describe, including a diagram, how the distribution and collection of materials and chemicals will take place and where the students should work.**

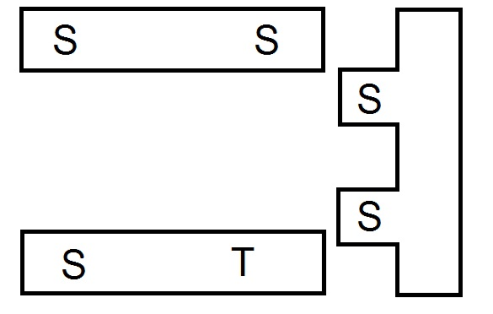


Figure 1. UTS Room 322.

Members of groups will be given roles (time keeper/safety monitor, reporter/recorder, facilitator, materials manager). Time keeper/safety monitor keeps an eye on time and makes sure lab safety rules are being followed. Materials manager retrieves and returns materials. The recorder/reporter records data and reports final data to teacher immediately. Facilitator assists and makes sure everyone participates.

Groups will be evening spaced out (indicated by the letter “S”). The teacher will be in a central location (indicated by the letter “T”). Only the materials manager from each group will retrieve the reagents and specialized equipment from the teacher’s bench.

**Create a protocol list for the “must do” prior the lab with respect to experiment. (i.e. preparation of solutions, exactly how many of each type of equipment required)**

|  |  |
| --- | --- |
| 500mL 0.1M HCl (100mL per group) | 10x500mL beaker (2 per group) |
| 500mL saturated Ca(OH)2 (100mL per group) | 10x100mL beaker (2 per group) |
| 1L distilled water (200mL per group) | 5x250mL beaker (1 per group) |
| 100mL 0.5% phenolphthalein indicator | 12 plastic transfer pipettes |
| Ice | Toothpicks |
| Sand | 5 hotplates (1 per group) |
| 5x6-well plates | 5 thermometers (1 per group) |

**Assessment /Evaluation of Student Achievement**

**What strategies will you use for this experiment? Describe why, how, and when you will implement these strategies. Include as BLMs, the assessment tools you will use (considering AaL, AoL, AfL).**

Refer to Solubility Lab Lesson Plan.

**Student Resources**

**What will you ask the students to do the night before the experiment? Include BLMs if appropriate (i.e. questions about particle theory related to gas laws) or any pre-lab questions, data charts to prepare...**

Refer to Solubility Pre-Lab.

**Produce a ready to use set of instructions (handout) that will allow the students to perform this experiment. Include title, purpose, procedure, safety warnings, and directions for how to record observations or an observation chart/table. Keep in mind that this will be used as a BLM.**

Refer to Solubility Lab.

**Provide 4 to 6 questions (as BLM) relating directly to the experiment for the students to answer. Be sure to include a variety of cognitive levels in your questioning.**

Refer to Solubility Lab.